Musculoskeletal Ultrasound Assessment of Enthesopathy in Fibromyalgia Patients

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ABSTRACT

Background: Fibromyalgia (FM) is a syndrome of persistent widespread pain, stiffness, fatigue, disrupted and unrefreshing sleep, and cognitive difficulties, often accompanied by multiple other unexplained symptoms, anxiety and/or depression, and functional impairment of activities of daily living

Objectives: To assess the frequency and pattern of enthesopathy in primary FM using musculoskeletal ultrasound with Glasgow Ultrasound Enthesitis Scoring System (GUESS) and Correlate these findings with clinical and laboratory parameters of FM.

Patients and Methods: A cross-sectional study includes 100 persons divided into two groups as follows: Group (1): 50 patients with primary fibromyalgia syndrome (FM) were diagnosed. Group (2): 50 apparently healthy controls with comparable age and sex. Patients were selected from those attending the outpatient clinic of the Rheumatology & Rehabilitation Department of Al-Azhar University Hospital, Assiut.

Results: There is no statistically significant difference between cases and control groups regarding age, gender, and BMI (P>0.05 for each), there were no statistically significant correlations between the GUESS scores and any of the clinical characteristics of FM patients. Although non-significant, these correlations were negative between the GUESS score and the tender point number, the Widespread Pain Index as well as the Fibromyalgia Impact Questionnaire. The total GUESS score of the FM group ranged between 0-12 with a mean ±SD of 5.3 ± 2.8. The total GUESS score of control group ranged between 0-6 with a mean ±SD of 0.97± 1.58, with a significant difference between the two groups (P<0.05)

Conclusion: There were significant enthesopathic changes detected among FM patients especially affecting the Achilles, quadriceps, and proximal patellar tendons.

Keywords: Fibromyalgia, Enthesopathy, Ultrasound, GUESS score.

INTRODUCTION

Fibromyalgia is a disorder of chronic, widespread pain, and tenderness. Chronic indicates the pain and tenderness have been present continuously for at least 3 months. Widespread means the pain and tenderness are on both sides of the body, above and below the waist, including the axial spine (usually the paraspinal, scapular, and trapezius muscles). While the identification of fibromyalgia patients by the original 1990 American College of Rheumatology (ACR) classification criteria required a specialized physical examination to quantify tender-point count that many providers have not been trained to perform, the 2010 ACR diagnostic criteria allow for diagnosis by history without specialized training [(1)].

In addition to chronic, widespread pain and tenderness, the 2010 diagnostic criteria require that fibromyalgia patients have significant symptoms of fatigue, unrefreshed sleep, and cognitive dysfunction (difficulties with thinking and remembering), along with numerous somatic symptoms [(1)]. Optimal treatment approaches are multidisciplinary, nonpharmacologic including education, exercise, and cognitive behavioral therapy, and pharmacotherapy including non-narcotic analgesics which downregulate nociceptive neuropeptides such as glutamate and upregulate pain inhibitory neuropeptides such as norepinephrine and serotonin, that is, reduce CS [(2)].

Enthesitis is the term used to describe inflammation at tendon, ligament, or joint capsule insertions. It thus applies to disease associated with spondylarthritis (SpA) including ankylosing spondylitis, psoriatic arthritis, reactive arthritis, and undifferentiated SpA. The term 'enthesopathy', however, has a wider meaning and designates all pathological abnormalities of insertions including inflammatory changes and degenerative problems [(3)].

Conventional radiography, ultrasonography, and magnetic resonance imaging are used to diagnose tendinopathies, bursitis, and other morphologic pathologies of the musculoskeletal system. Musculoskeletal ultrasonography is a widely available and inexpensive imaging tool and demonstrates fluid collections, soft tissue lesions, and bone surface lesions with sensitivity comparable with magnetic resonance imaging. The sonographic examination is more sensitive and specific than clinical examination for the detection of enthesitis and tendon involvement [(4)]. Developments of high-resolution transducers of ultrasonography (US) have made it possible to assess enthesitis more accurately than clinical examination.

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Several reports are describing the use of the US in determining the features of lower limb enthesitis by using the Glasgow Ultrasound Enthesitis Scoring System (GUESS) [5]. The sonographic features of enthesitis include hypoechoic thickening of the tendon or ligament, erosion, spur formation, and bursitis [6].

AIM OF THE STUDY

This study aimed to assess the frequency and pattern of enthesopathy in primary FM using musculoskeletal ultrasound with Glasgow Ultrasound Enthesitis Scoring System (GUESS) and to correlate these findings with clinical and laboratory parameters of FM.

PATIENTS AND METHODS

Patients were selected from those attending the outpatient clinic of the Rheumatology & Rehabilitation Department of Al-Azhar University Hospital, Assiut, Egypt.

This study comprised 50 primary FM patients (mean age 31.86+7.31 years, 47 females and 3 males) and 50 apparently healthy age- and sex-matched controls (mean ± SD 31.64±8.36 years, 45 females and 5 males)

Inclusion Criteria: All patients should satisfy the Preliminary Diagnostic Criteria for the diagnosis of FM [1] if the following three conditions are met: Widespread pain index (WPI) ≥ 7 and symptom severity (SS) scale score ≥5 or WPI 3-6 and SS scale score ≥9, Symptoms have been present at a similar level for at least 3 months and the patient does not have a disorder that would otherwise explain the pain.

Exclusion Criteria: History of psychological disorders before the diagnosis of FM, family history of psychological disorders, presence of an autoimmune disease, Severe chronic disabling conditions like severely complicated diabetes mellitus (DM) or hypertension (HTN) and known malignancy. After obtaining written consent.

All patients in this study were subjected to:

A) Full History taking:

1- Personal history: Name, Age, Sex, Occupation, Marital status, and offspring's, Residence, Special habits of medical importance.

2-Complaint: Taken in the patient's own words.

3-Present history:

- Inquiry with careful details concerning onset, course, and duration of the disease, precipitating factors (trauma, infection, emotion, or others).
- Constitutional manifestations: Easy fatigability (duration, severity, and its effect), Loss of appetite, or weight loss.
- Musculoskeletal affection
- Morning stiffness: location and duration in minutes.
- History suggestive of Raynaud's phenomenon.
- Manifestations of other systems affection.

B) Complete physical examination:

General examination:

Vital signs, general appearance, body-built facies, height, weight, and body mass index (BMI kg/m2). Systemic clinical Examination (skin, CNS, CVS, GIT, Genito-urinary, etc.)

Local Examination of the locomotor system:

All joints of the body are examined thoroughly, inspection, palpation, movements, and special tests to detect effusion and stability. Para-articular structures (tendons, ligaments…etc.) were also assessed.

Assessment of enthesopathy:

Physical examination: to site of entheseal insertion that includes:

a) The inferior pole of the calcaneus: plantar aponeurosis enthesis,
b) The superior pole of the calcaneus: Achilles tendon enthesis,
c) The tibial tuberosity: distal patellar ligament enthesis,
d) The inferior pole of the patella: proximal patellar ligament enthesis,
e) The superior pole of the patella: quadriceps tendon enthesis,

Each site examined for by:

• Inspections: for redness, swelling.
• Palpation: tenderness, swelling, underlying condition.
• Motion: to check for restricted mobility at the affected joint.

Sonographic examinations were performed: MSUS equipment was (Toshiba Xario200), with a linear 10–12 MHz probe. Contact gel was applied to the skin to provide an acoustic interface. Sonographic evaluations and scoring were performed according to the Glasgow Ultrasound Enthesitis Scoring System (GUESS), which includes evaluation of the quadriceps tendon, patellar ligament, Achilles tendon, plantar fascia thickness, enthesophytes and erosions at the origin, and attachment sites of the tendons listed above. Suprapatellar, infrapatellar, and retrocalcaneal bursae were also evaluated. Examination of the superior pole of the patella (quadriceps tendon insertion), the inferior pole of the patella (patellar ligament origin), and patellar ligament insertion at the tibial tuberosity was performed with the patient in the supine position with the knees flexed at 30. For the examination of the Achilles tendon and plantar aponeurosis, the patient was in the prone position with the feet hanging over the edge of the examination table at 90 flexions [4].

C) Laboratory investigations: including CBC, ESR, CRP, RF, ANA, and thyroid function tests.

D)

Assessment of tender points number:

Using Manual tender points survey (MTPS) to assess the number of tender points to diagnose FM syndrome. The patient experiences pain on palpation in at least 11 of 18 tender points. (Survey sites 1, 16, and 17 are control points and do not count toward the total number of painful tender points.

Assessment of pain using the visual analog scale (VAS): The VAS measurement is a common method used for pain evaluation. The score was obtained by measuring the line in centimeters from 0 to the point marked by the patient.

Fibromyalgia Impact Questionnaire (FIQ): FIQ is an assessment and evaluation instrument specifically designed to reflect changes in the FM patient's general health status over time. It has been designed to measure the components of health status that are believed to be most affected by FM.

Beck Depression Inventory: The Beck Depression Inventory (BDI) is the most widely used self-rating scale, developed in 1961 **by Aaron Beck**[7] based on symptoms he observed to be common among depressed patients.

Beck Anxiety Inventory (BAI): Beck Anxiety Inventory (BAI), Created by **Aaron Beck**[7] and other colleagues, is a 21-question multiple-choice self-report inventory that is used for measuring the severity of anxiety in children and adults [8]**.** The questions used in this measure ask about common symptoms of anxiety that the subject has had during the past week (including the day you take it) (such as numbness and tingling, sweating not due to heat and fear of the worst happening). It is designed for individuals who are of 17 years of age or older and take 5 to 10 minutes to complete.

Ethical considerations:

This study was approved by the ethical committee of the Faculty of Medicine Al-Azhar (Assuit) University.

Statistical methods

Data obtained from the present study were computed using SPSS Version 22 under the platform of Microsoft Windows 10, Professional Edition. Continuous data were expressed in the form of Mean±SD. While categorical data were expressed in the form of count and percent. A comparison of continuous data was performed utilizing Student's tests (t), while categorical data were done using Chi-square (X2) test. The non-significant difference if P>0.05.

The significant difference if P<0.05. The highly significant difference if P<0.001.

RESULTS

Table (1): Comparison between studied groups regarding age, sex, and body mass index (BMI)

	Cases (50)	Control (50)	P-value
Age (Years):			
(Range) Mean ± SD	(18-47) 31.86±7.31	(19-47) 31.64±8.36	0.211
Gender: n (%)			
Male	3 (6)	5 (10)	0.509
Female	47 (94)	45 (90)	
BMI (kg/m^2):			
(Range) Mean ± SD	(17-35) 27.6±4.5	(19-35) 26.9±4.5	0.541

There is no statistically significant difference between cases and control groups regarding age, gender, and BMI (P>0.05 for each).

Table (2): Frequencies of clinically affected entheses (tender and/or swollen) in patients with FM

Affected sites	No. of patients=42/50 (84)		
	(%) Regarding prevalence=500 (100)	(%) Regarding distribution=48 (100)	(%) Regarding site=100 (100)
Plantar Fascia (16)	3.2	33.3	16
Achilles tendon (11)	2.2	22.9	11
QT (8)	1.6	16.6	8
PPT (7)	1.4	14.58	7
DPT (6)	1.2	12.5	6

PPT: Proximal patellar tendon, DPT: Distal patellar tendon, QT: quadriceps tendon.

A total of 500 entheseal sites (10 sites× 50 patients) were examined **clinically** by palpation for tenderness and/or swelling (enthesopathy). Enthesopathy was **clinically** found in 48/500 (9.6%) examined entheseal sites in 42 patients (84%). Clinical affection was distributed mostly at the inferior pole of the calcaneus (plantar fascia) in 16/48 (33.3%) with a prevalence of 16/500 (3.2%), followed by the superior pole of the calcaneus (the Achilles tendon) in 11/48 (22.9%) with a prevalence of 11/500 (2.2%), the quadriceps tendon in 8/48 (16.6%) with a prevalence of 8/500 (1.6%), the proximal patellar tendon in 7/48

(14.58%) with a prevalence of 7/500 (1.4%) and the distal patellar tendon in 6/48 (12.5%) with a prevalence of 6/500 (1.2%), as shown in **(Table 2).**

Table (3): Frequencies of affected entheses detected by the US in patients with FM

Affected sites	No. of patients=42/50 (84)		
	(%) Regarding prevalence= 500 (100)	(%) Regarding distribution= 102 (100)	(%) Regarding site= 100 (100)
Plantar Fascia (32)	6.4	31.37	32
Achilles tendon (27)	5.4	26.47	27
QT (15)	3	14.7	15
PPT (15)	3	14.7	15
DPT (13)	2.6	12.74	13

Using musculoskeletal ultrasound (MSUS), entheseal abnormalities were detected in 102/500 (20.4%) sites. This involved 45/50 (90%) of patients. Bilateral affection was encountered in 25/45 patients (55.5%), while 20/45 patients (44.4%) had unilateral affection with the right side more affected.

All patients with clinical involvement had US abnormalities: US abnormalities most commonly affected the Achilles tendon in 32/102 (31.37%) with a prevalence of 32/500 (6.4%), followed by the plantar fascia in 27/102 (26.47%) with a prevalence of 27/500 (5.4%), the quadriceps & proximal patellar tendon 15/102 (14.7% each) with a prevalence of 15/500 (3% each), while the distal patellar tendon was the least affected site in 13/102 (12.74%) with a prevalence of 13/500 (2.6%); as shown in **(Table 3).**

Table (4): Comparisons between FM patients and the control group regarding the distribution of the affected entheses detected by the US.

	FM (102)	Controls (29)	P-value
	Distribution n (%)		
Achilles tendon	27 (26.47)	11 (37.9)	0.072
Plantar Fascia	32 (31.37)	15 (51.7)	0.094
PPT	15 (14.7)	3 (10.34)	0.052
QT	15 (14.7)	0 (0)	0.062
DPT	13 (12.74)	0 (0)	0.055

The control group had US involvement in 29/500 sites (5.8%), although they were all clinically free. This affected 16/50 subjects (32%). 2 subjects had bilateral involvement (12.5%), while 14 subjects (87.5%) had unilateral affection with the right side more commonly involved). US abnormalities most commonly affected the Achilles tendon in 15/29 (51.7%) with a prevalence of 15/500 (3%), followed by the plantar fascia in 11/29 (37.9%) with a prevalence of 11/500 (2.2%) and the proximal patellar tendon was the least affected site in 3/29 (10.3%) with a prevalence of 3/500 (0.6%). No abnormalities were detected in the quadriceps or the distal patellar tendons with no significant difference between FM patients and the control group regarding the distribution of the affected entheses detected by US (P>0.05 for each), as shown in **(Table 4)**.

Table (5): Comparisons between FM patients and the control group regarding the prevalence of affected entheses detected by the US.

	FM (500)	Controls (500)	P-value
	Sites n (%)		
Plantar Fascia	32 (6.4)	15 (3)	0.094
Achilles tendon	27 (5.4)	11 (2.2)	0.072
PPT	15 (3)	3 (0.6)	0.073
QT	15 (3)	0 (0)	0.055
DPT	13 (2.6)	0 (0)	0.098

There were statistically no significant differences between the FM patients' group and the control group regarding the frequency of US involvement at affected entheseal sites (p>0.05 for each), as shown in **(Table 5)**.

Table (6): Comparisons between FM patients and the control group regarding the prevalence of US entheseal findings (elemental lesions).

	FM (500)	Controls (500)	P-value
	Sites n(%)		
Abnormal tendon structure	99 (19.8)	22 (4.4)	0.001
Tendon thickening	90 (18)	6 (1.2)	0.001
Calcifications	29 (5.8)	6 (1.2)	0.001
Erosions	10 (2)	0 (0)	#
Bursitis	17 (3.4)	3 (0.6)	0.015

There was a highly statistically significant difference between FM patients and the control group regarding the prevalence of abnormalities in tendon structure (**p**<0.001), tendon thickness (**P**<0.001), and calcifications (**P**<0.001). There was also a statistically significant difference between the FM patients and the control group regarding the presence of bursitis (**P**<0.05)**.** None of the controls had erosions, as shown in **(Table 6).**

Table (7): Comparisons between FM patients and the control group regarding the GUESS score.

	FM	Controls	P-value
	(Range) mean ±SD		
Total GUESS score	(0-12) 5.3 ± 2.28	(0-6) 0.97± 1.58	0.035

The total **GUESS score** of the FM group ranged between 0-12 with a mean ±SD of 5.3 ± 2.8. The total **GUESS score** of the control group ranged between 0-6 with a mean ±SD of 0.97± 1.58, with a significant difference between the two groups, as shown in **(Table 7).**

Table (8): Frequency of abnormal entheses detected by the US in clinically free entheseal sites of FM patients.

US Affected Sites=102	Clinically free sites=54 (52.9%)
Achilles tendon(32)	21 (65.6)
Plantar fascia (27)	12 (44.4)
QT (15)	7 (46.6)
PPT (15)	9 (60)
DPT (13)	5 (38.4)

Fifty-four/102 entheseal sites (52.9%) clinically free from pain, tenderness, or swelling (enthesopathy) in FM patients showed MSUS abnormalities detected, as shown in **(Table 8).**

Table (9): Correlations between the guess scores and clinical characteristics of FM patients.

	Spearman's correlation coefficient	
	(r)	**P-value**
Age (years)	0.12	0.44
Disease Duration	0.09	0.59
BMI (kg/m2)	0.03	0.83
No. of TP	-0.06	0.70
WPI	-0.18	0.25
SSS	0.13	0.43
VAS	0.04	0.79
FIQ	-0.005	0.97
ESR	0.01	0.92

In the FM patients' group, there were no statistically significant correlations between the GUESS scores and any of the clinical characteristics of FM patients. Although non-significant, these correlations were negative between the GUESS score and the tender point number, the Widespread Pain Index as well as the Fibromyalgia Impact Questionnaire, as shown in **(Table 9).**

CASES OF ULTRASONOGRAPHY

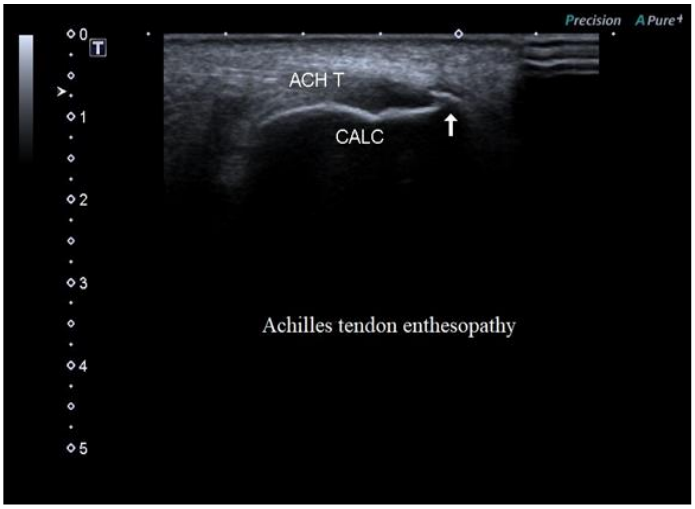

Figure (1): A longitudinal sonographic view of the Achilles tendon showing Achilles tendon enthesopathy: **Enthesophyte** at Achilles enthesis level (arrow). In a Female patient aged 41 years with FM.

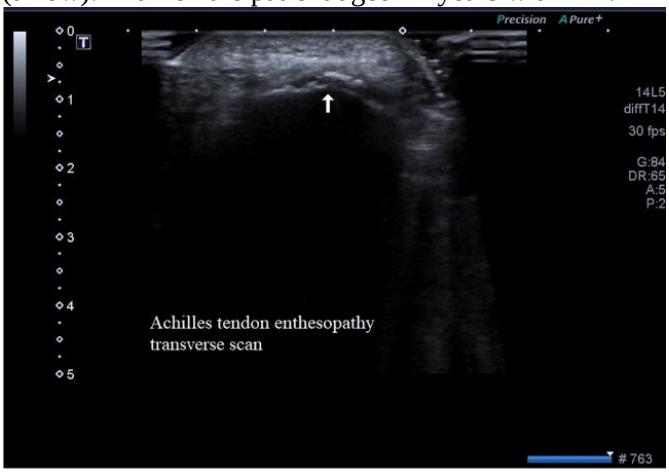

Figure (2): A transverse scan of Achilles tendon of the same case in the previous **Figure (1)** showing: Achilles tendon enthesopathy: **Enthesophyte** at Achilles enthesis level (arrow).

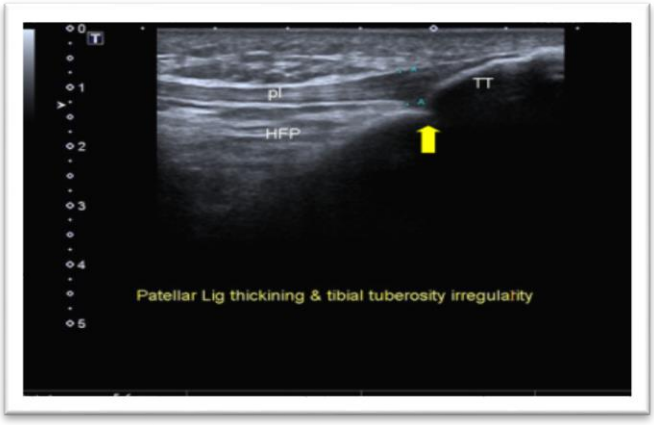

Figure (3): A longitudinal scan of Patellar Ligament tendon showing: Distal patellar ligament enthesopathy**: Increase of tendon thickness. Tibial Tuberosity irregularities at the insertion site (arrow).** In a female patient aged 45 years with FM.

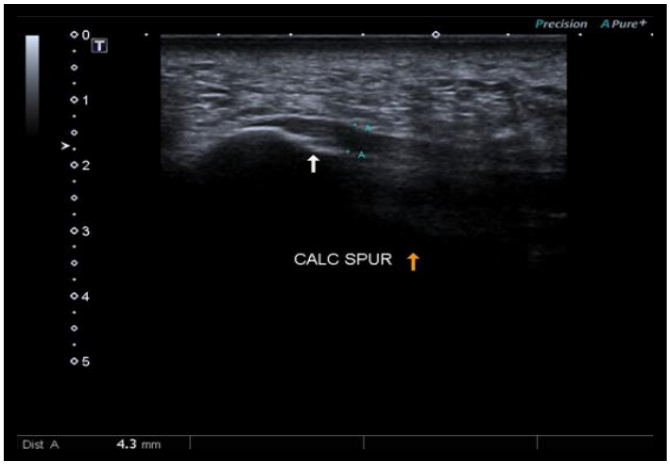

Figure (4): A longitudinal scan of Plantar fascia showing Plantar fascia tendinopathy: **Thickening of the tendon,** with **a calcaneal spur (arrow)** in 44 years old FM patient.

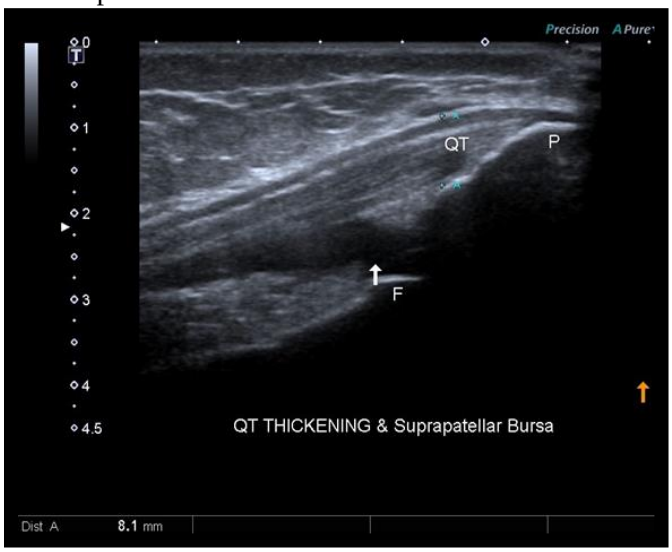

Figure (5): A longitudinal scan of Quadriceps tendon showing a Quadriceps tendon **enthesopathy** with **an increase in the tendon diameter about 8.1 mm** and **suprapatellar bursa** in FM female patient aged 32 years. **Achilles tendon (line) in a 29-year healthy woman.**

DISCUSSION

In our study patients with primary Fibromyalgia FM were (3 males 6%) and (47 females 94%) that were comparable with other studies of **Ozcetin *et al.*** [9], **Schaefer *et al.*** [10] and **Linares *et al.*** [11]; whose studies included 97.4%, 94.6% and 92.1% female patients respectively. This relationship may be explained by biological, hormonal, and social factors [12]**. Weir *et al.*** [13] stated that the female gender seems to be a risk factor for chronic pain. The mean age of our FM group was 31.86+7.31 years (18 to 47 years) which is near to similar to that reported in the studies of **Pamuk *et al.*** [14]**, Birtane *et al.*** [15] **and Okifuji *et al.*** [16] of 42.2 years, 45.83 years and 45.3 years respectively. Higher ages of patients were also reported by **Orellana *et al.*** [17] **and Schaefer *et al.*** [10]**;** 49.6 years and 47.9 years respectively. However, the mean age in the present study is less than that reported by **Wolfe *et al.*** [1]**,** which was around 54 years in both studies. They explained this finding by the fact that pain in older individuals could be misdiagnosed as age-related, which subsequently leads to a delayed diagnosis.

In the present work, the mean disease duration was 13.7±11.0 months (3 to 48 months), that was less than that observed by **Gur *et al.*** [18] **and Ozcetin *et al.*** [19] who found the mean duration of disease was 5.5, 3.96 and 3.41years respectively. This difference may be attributed to advances in technologies of imaging and diagnostic criteria since then. A higher BMI (kg/m^2) was observed in our FM patients than in healthy subjects (mean: 27.6 m^2 /kg **vs**. 26.9 m^2 /kg) though insignificantly different (**P**>0.05). This is concordant with that of **Góes *et al.*** [20]**, Fahmi and El-Shafey** [21]**, and Roehrs *et al.*** [22]**.**

Apart from tender points, FM patients had enthesitis confirmed in our study by the finding of US abnormalities in all clinically tender or swollen entheses. Meanwhile, some patients as well as healthy controls who had no clinical tenderness at entheseal sites showed US abnormalities. It is thought that microtrauma to fibrocartilage structures is the principle of enthesitis development. In this regard, the evaluation of target areas at anatomical locations prone to trauma injuries such as the foot and the knee could be enough to reflect total enthesitis [23]. In our study, clinical enthesopathy was diagnosed in 48/500 (9.6 %) of the examined entheseal sites being tender to palpation and/or swollen in 42 patients (84%). This was distributed at plantar fascia (3.2%), the Achilles tendon (2.2%), the quadriceps tendon (1.6%), the distal patellar tendon (1.4%), the proximal patellar tendon (1.2%).

Histological examination of the enthesis is the potential gold standard for the evaluation of enthesitis but is rarely obtained due to ethical and practical constraints [24]. Using MSUS, entheseal abnormalities were detected in 102/500 (20.4%) sites. This involved 45/50 (90%) of FM patients. Bilateral affection was encountered in 25/45 patients (55.5 %), while 20/45 patients (44.4 %) had unilateral affection with the right side more affected.

In FM patients, US abnormalities affected the Achilles tendon in 6.4%, followed by the plantar fascia in 5.4%, the quadriceps & proximal patellar tendon 3% each, while the distal patellar tendon was the least affected site in 2.6%. These frequencies differ from other results found in the literature **Ozkan *et al.*** [9], reported pathological US abnormalities to be more frequently higher at Achilles enthesis in FM patients, whereas relatively low scores at the proximal patellar tendon enthesis and they attributed the higher scores to the higher frequency of tendon calcifications which is very common in an asymptomatic person. Also, **Marchesoni *et al.*** [25], showed that changes in the greyscale combined with PD were more prevalent in

the lower extremity entheses in a group of 30 FM patients and they reported more frequent enthesopathic abnormalities at the Achilles tendon. The predilection of the enthesitic process for the distal part of lower limbs can be explained by anatomic and physiological factors, such as the major length of the tendon. The major length of the Achilles tendon or its movement on the adjacent bursa may be responsible for a more relevant mechanical injury at this ethereal site.

Enthesopathy at the distal patellar tendon insertion was the least frequent to be detected in our study, several anatomical factors such as bone widening and sharp change in the fiber orientation can lead to anisotropic artifact causing a misleading view [(26)]. Also, **Ozkan *et al.*** [(9)] stated that the existence of thick skin and subcutaneous tissue overlying the plantar fascia may decrease the sensitivity of the US. In the control group, although they were all clinically free, US abnormalities most commonly affected the Achilles tendon in 3%, followed by the plantar fascia in 2.2%, and the proximal patellar tendon was the least affected site in 0.6%. No abnormalities were detected in the quadriceps or distal patellar tendons.

There were statistically no significant differences (P>0.05) between the FM patients' group and the control group regarding the frequency of US involvement at affected entheseal sites.

Gutierrez *et al.* [(5)], reported that in the healthy population, US detected enthesopathy in 38 of 450 (8.4%) entheseal sites. In this group, the entheseal sites with the highest number of US signs of enthesopathy were the quadriceps enthesis (2.8%) and the Achilles enthesis (2.7%), followed by the proximal patellar enthesis (2.2%) and the distal patellar enthesis (0.6). No changes occurred in the plantar aponeurosis enthesis as well as no PD signal was detected in healthy controls.

The absence of PD in healthy controls suggests a very high specificity of positive Doppler signal to enthesopthy with inflammatory nature [(27)]**.** The most prevalent elemental lesion in our patients was the abnormal tendon structure (19.8%), followed by increased tendon thickness (18%), calcifications (5.8 %), bursitis (3.4 %), and erosions (2%). present in 1.3%. The total GUESS score ranged between 0-12 with mean ±SD of 5.3±2.8.

MSUS in the control group revealed that the most common elemental lesion was the abnormal tendon structure (4.4%), followed by increased tendon thickness and calcifications (1.2% each), and bursitis (0.6%). The total GUESS score ranged between 0-6 with a mean ±SD of 0.97±1.58.

There was a highly statistically significant difference between FM patients and the control group regarding the prevalence of abnormalities in tendon structure (P<0.001), tendon thickness (P<0.001), calcifications (P<0.001) and the GUESS score (P<0.001). There was also a statistically significant difference between the FM patients and the control group regarding the presence of bursitis (**P**<0.05) and the GUESS score (P<0.05). None of the controls had erosions.

Marchesoni *et al.* [(25)]**,** studied the use of greyscale and power Doppler US to distinguish between enthesitis of psoriatic arthritis and FM and found tendon hypoechogenicity as the main component of structural damage in about 7% of examined entheseal sites of FM patient group. In our study, the mean GUESS score in FM patients was significantly higher than in the control group. This confirmed the results of **Ozkan *et al.*** [(9)] using the MASEI score. In our FM patients' group, there were no statistically significant correlations between the mean GUESS score and any of the clinical characteristics of FM patients [the patients' ages (**r**=0.12, p>0.44), disease duration (**r**=0.09 , p>0.59), BMI (**r**=0.03, p>0.83), number of tender points (**r**=-0.06 ,p>0.70), Wide Spread Pain Index (**r**=-0.18, p>0.25), visual analogue scale (**r**=0.04, p>0.79), Symptom Severity Scale (**r**=0.13, p>0. 43), Fibromyalgia Impact Questionnaire (**r**=-0.005, p>0.97), and ESR (**r**=0.01,p>0.92)]. Also, **Bakan *et al.*** [(28)]**,** found that the frequency of entheseal abnormalities was significantly increased in FM patients independent of TPs involvement when compared to healthy controls. In our study, correlations between the GUESS score and the tender point number, the Widespread Pain Index as well as the Fibromyalgia Impact Questionnaire was negative although non-significant.

CONCLUSION

- There were significant enthesopathic changes detected among FM patients especially affecting the Achilles, quadriceps, and proximal patellar tendons.
- Detection of enthesopathic changes in FM using Musculoskeletal Ultrasonography may be helpful to support the diagnosis and to avoid mistreatment.
- Musculoskeletal Ultrasonography is a suitable and reliable method for examining entheseal structures with great resolution because most of these are superficial structures. Entheseal abnormalities can be documented by ultrasonography in clinically asymptomatic patients with FM. These findings could be related to subclinical entheseal inflammation.
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